

## CEREBRO-SPINAL FEVER.

*By William Osler, M.D.,*

Professor of Medicine, Johns Hopkins University.

A CLINICAL LECTURE ON SEVEN CASES AT THE JOHNS HOPKINS HOSPITAL, DELIVERED BEFORE THE POST-GRADUATE CLASS, JUNE 15, 1898.

I WISH to speak to you today about "a singular and very mortal malady," to use the words of Danielson and Mann, the original observers of cerebro-spinal fever in this country. We have been much interested in studying a series of cases that have come under our observation recently, and I thought the present a fitting opportunity to review the subject while it is fresh in your minds. The history of the disease in this country is given in various works. Hirsch's "Geographical Pathology" contains a very full statement. Volume I of Joseph Jones's "Medical and Surgical Memoirs" gives in many ways the best description of the early outbreaks, unless you wish to go to the original authorities. The recent monograph by Councilman, Mallory and Wright, issued by the Massachusetts State Board of Health, descriptive of the epidemic in and about Boston, is the best modern presentation of the subject from all standpoints.

Briefly summarized, the disease has appeared in this country in four different periods. In 1806, the year after the first description of the disease in Geneva, an outbreak occurred in Medford, Mass., which was very carefully studied by Danielson and Mann. During the next twenty years there were numerous outbreaks throughout the country. One of

the early descriptions of the disease is by Dr. Williamson, who recorded an outbreak in this city in 1808. The second period dates from about 1840 to 1850. It was during this time that the disease was very thoroughly studied by Ames, of Montgomery, Ala. The third period extends from 1860 to 1874, in which there were severe local outbreaks. During the civil war there were numerous epidemics, those in the Northern army you will find referred to in the "Medical and Surgical History of the War," those of the Confederate forces are in this really extensive memoir of the disease by Joseph Jones. Since 1874 sporadic cases have occurred at intervals in different places, but there have been no extensive epidemics. In 1893 there were outbreaks in New York and Western Maryland, which were studied by Drs. Flexner and Barker, and in Boston and parts of Massachusetts there have been cases since the summer of 1896.

As an epidemic, cerebro-spinal fever presents several interesting points. The disease is never pandemic; that is, widely and extensively diffused over large areas of country, but the outbreaks are more or less localized. There is an absence of any continuous extension. Thus at present the disease lingers in Massachusetts. We have heard of cases occurring in parts of the Southern States, and we are probably here on the eve of an outbreak, and cases are reported to have occurred among the miners at Skaguay, on the way to Klondike. For years subsequent to an epidemic sporadic cases of the disease occur, and you will see year by year cerebro-spinal fever as a cause of death in the health reports of the larger Eastern cities. A majority of these cases are,



however, other forms of meningitis, or the cerebro-spinal form of typhoid fever.

Passing now to the more practical aspect of the question, let me read you brief abstracts of the histories of the seven cases which we have had under observation within the past few weeks.

Case 1.—On March 24 a colored boy, John H., aged twenty, was admitted, complaining of chills and fever. The history was very difficult to obtain, as he was incoherent. Subsequently we found out that he had been working at Hawkins's Point since August, where he had had frequent attacks of chills and fever. He worked until noon of the 21st, when he suddenly lost power in his left leg and sank to the ground. Placed on his mule he started home, but fell off several times. He states also that he lost power in both arms. This condition continued for the past three days, during which time he was not able to make a step alone. He was brought to the hospital by three men. His temperature shortly after admission was  $103^{\circ}$ .

He was a well-nourished, healthy-looking boy. There was ptosis of the right eyelid, dilatation of the pupil of the right eye, but no strabismus. The spleen was not palpable. The patient sat up with difficulty, complained of a great deal of pain in the back. He sweated profusely during the examination. The examination of the lungs was negative. There was a leucocytosis of 26,000.

On the 24th herpes were present on the lips. There was very marked stiffness of the neck and retraction of the head. The temperature during the first week was distinctly remittent, a diurnal range of from two to three degrees, the maximum between  $103^{\circ}$  and  $104^{\circ}$ .

On the 29th of March, the eighth day of his illness, Dr. Thayer obtained by lumbar puncture 40 cc. of a cloudy fluid without blood. It was sterile both on color-slips and in culture.

On the 30th and 31st the patient was very much better, the mental condition clearer. He was rational; the ptosis had disappeared, but there was still stiffness of the muscles of the neck. Between 8 P. M. on March 31 and 8 P. M. on April 1 the temperature fell from  $102^{\circ}$  to nor-

mal and remained so. He made a rapid convalescence, and left the hospital on May 12.

Case 2.—Henry T., aged twenty-three, was brought to the hospital actively delirious on April 10. There was nothing of moment in his family history.

Until April 6 the patient was well and strong. He worked on the morning of the 6th, and in the evening he had a violent shaking chill.

On the 7th he complained greatly of pains in his head and back. The temperature was  $101^{\circ}$ . He was very dull, and had a muttering delirium.

On the 8th the headache was very intense. The temperature ranged between  $102^{\circ}$  and  $103^{\circ}$ . He continued delirious on the 9th, and was brought to the hospital on the morning of the 10th.

On admission he was delirious, pupils were widely dilated; the tongue was dry and coated. The spleen could not be felt. There was no herpes. The temperature was  $104^{\circ}$ .

On the 11th the delirium continued. There was marked stiffness of the muscles of the neck, and there was a leucocytosis of 22,000. There were no rose spots, no eruption on the skin. Albumen and tube casts were present in the urine. The pupils were of medium size, reacted to light. He had had no special stomach symptoms.

On April 12 a lumbar puncture was made, and only about fifteen drops of a clear serous fluid was obtained, which was negative on cover-slips and also in culture media. The spleen was not palpable. The temperature was distinctly remittent, ranging from  $100^{\circ}$  to  $102.5^{\circ}$  and  $103^{\circ}$ .

On the 18th and 19th it was more continuous. On the 20th it dropped to  $99^{\circ}$ , and on the morning of the 21st he had a severe shaking chill, and the temperature rose to nearly  $105^{\circ}$ . The pupils were equal; the ophthalmoscopic examination showed nothing abnormal. Following the chill on the 21st the temperature fell again to  $99^{\circ}$ , and on the 22d there was a second severe chill, in which the temperature rose to nearly  $105^{\circ}$ , and fell to normal on the 23d, and the patient entered upon an uninterrupted recovery.



In this patient the sudden onset, the headache, the marked cerebral symptoms, the stiffness of the neck, the leucocytosis, which ranged from 22,000 to 28,000, and the absence of all signs of typhoid fever, the prompt recovery, suggested strongly cerebro-spinal meningitis, though the cultures were negative.

Case 3.—John G., school boy, aged eight, admitted April 21, with headache and pain in the back of the neck. His illness began five weeks ago. He was brought home one evening supported between two playmates, complaining of severe headache and pain in the back of the neck. He became delirious, and for six or seven days had high fever, retraction of the head and stiffness of the muscles of the neck, and a great deal of vomiting. These symptoms continued until admission.

He was very much emaciated, and looked as though he had been through a serious illness. The temperature was 102.5°. He still complained of headache, but seemed rational and answered questions promptly. The pupils were equal. He had signs of herpes about the septum of the nose. The spleen was not palpable. He was a little dull and heavy during the following day, and the neck seemed to be very stiff. He had a leucocytosis of 13,000. There was no Widal reaction. Two days after admission his temperature became normal and he began to improve, and got well very rapidly.

In this case the sudden onset, the marked cerebral symptoms for four or five weeks with retraction of the neck, the stiffness in which persisted after admission, and the absence of signs of typhoid, were also very suggestive of the cerebro-spinal fever. The lumbar puncture was not made in this case.

Case 4.—Wm. A., colored, aged twenty-eight, cook, admitted May 12, complaining of headache, pain and stiffness in the neck. He had been a very healthy man. The present illness began suddenly on April 14, four weeks previous to admission, with violent headache and nausea. That night he became delirious, and has been so at times ever since. For the four weeks he has had

fever, sweating, pain in the head, retraction of the head and great stiffness in the muscles of the neck. On admission the temperature was 100.5°. He was rational, but drowsy, and slow in responding to questions. He lay on the left side, with the head markedly retracted and held stiffly. It could not be pushed forward even to a very slight extent either voluntarily or passively. There was no leucocytosis; the Widal reaction was absent. The retinæ and nerves were negative.

On May 13 we noted that there was marked retraction of the head, which was held very stiffly and could not be lifted from the pillow without raising the whole body. The general condition seemed to be very good; temperature was 98°. On the following morning when I saw him he seemed rational. He sat up in bed himself, but was quite unable to move his head forward. From this time on he had no fever, gained rapidly, but the uncomfortable sensation of stiffness in the neck remained as late as June 11, the time of his discharge.

These four cases had aroused our suspicions, though two of them had come in practically convalescent, and in the other two we had not been able to arrive at a positive diagnosis from the lumbar puncture. Then in rapid succession three cases were admitted about which there could be no question, and which removed any lingering doubt as to the nature of the previous cases.

Case 5.—John L. H., aged thirteen, school boy, admitted May 31, with headache, much pain, and a temperature of 103°. He had been a very healthy boy, and came of healthy stock. On May 28, 29 and 30 he felt very ill, had pain in the head and persistent vomiting. On the 30th he said that he could not see out of either eye, and there was a droop in the right eye.

On admission he was a healthy-looking and well-nourished lad; temperature 103°. He was very restless, threw his arms about and talked irrationally. There was ptosis of the right lid; the right pupil was dilated, and there was marked strabismus. The head was not retracted, but it was held stiffly. The



pulse was full and bounding, 104°. There were no changes in the retinae. There was a leucocytosis of 31,000. On June 1 his temperature rose to 105°. By lumbar puncture about 50 cc. of an opalescent fluid were obtained, which showed diplococci on cover-slips. On June 2 herpes developed on the nose, and purpuric spots appeared on the neck and chest. The temperature was remittent. It sank to 99° on the morning of the 2d, and rose throughout the day to nearly 104°. He cried out a great deal with pain in the head, and could not bear to have the neck touched or moved. When questioned he seemed perfectly rational, but when left to himself he had a wandering delirium.

On the 3d and 4th he seemed a little better. On the night of the 4th he became very much worse, very delirious, and tried to get out of bed. The pulse became more rapid; there were signs of marked bronchitis at the bases, and the leucocytosis reached nearly 45,000. He became very cyanosed, with an extraordinary fulness and pulsation of the peripheral veins. There was marked congestion and fulness of all the vessels of the retinae, but no optic neuritis. The temperature fell to sub-normal, 97°, rose on the 5th at 1 P. M. to 100°, when he died.

The report of the cultures by Mr. Knox under Dr. Flexner's supervision showed the diplococcus intracellularis. Cultures from the nose did not show any organisms.

In this case the boy died about the eleventh day of a very acute illness, and there was no question as to the nature of the trouble. The post-mortem, which most of you saw, confirmed the diagnosis. I will read you the anatomical diagnosis. Epidemic cerebro-spinal meningitis—basal and spinal exudate; acute sero-purulent ependymitis; bronchopneumonia and bronchitis. I show you here a portion of the cord which has been preserved, and you see how completely plastered it is with the exudate.

Case 6.—Martha K., aged eight, admitted June 1 in a state of unconsciousness. She had been a very healthy child. On May 30 she had been perfectly well,

and had spent the day picking peas. On coming from the field she complained of headache, walked slowly, vomited and complained of pain in the back. At 7 P. M., when she reached home, she lay down on a bench and vomited again. She vomited also through the night. She was restless, but slept.

On the 31st she felt hot at times and cold, and slept all day, and could not walk. She had castor oil, and the bowels were moved. She was unconscious all day. There was no nose-bleeding.

On admission the temperature was 101°. She was unconscious, and the lips were dry. There were herpes at the angle of the mouth. There was marked retraction of the head and neck, but there was no pain. The spleen was not palpable. There was no rash on the skin.

On the 2d her temperature rose to above 104°. The condition remained practically the same. A turbid fluid was removed by lumbar puncture, which showed numerous diplococci. The leucocytosis has been from 20,000 to 25,000. On June 3 her condition was practically the same. The temperature was markedly remittent, dropped to 100.5° and then rose to nearly 105°. She had difficulty in swallowing; the retraction of the head was extreme, and at intervals there we. At 2 o'clock on this day an erythematous eruption was noticed over the neck. The respirations became very much increased. There were no changes in the retinae.

On June 4 she became very much worse; there was a patchy erythema on the hands; none on the trunk. The temperature rose again to nearly 105°, and she died on June 4, on the sixth day of her illness. The cultures showed the diplococcus intracellularis.

Case 7.—Edward R., aged forty-seven, admitted June 4 in a condition of active delirium. He had had a severe attack of cerebro-spinal meningitis five years ago, and he had also had pneumonia. He had been a heavy drinker. His illness began on June 2 with a chill. On the 3d he had a second chill, and became irrational, and his wife noticed the stiffness in the neck. He suffered very much with



his head, and breathed very heavily. He was very delirious all the night of the third.

On admission his face was flushed. There was visible pulsation in the vessels of the neck and Cheyne-Stokes respiration. The pupils reacted well, but were somewhat dilated. He was in a heavy stupor, breathed noisily, answered questions in a wandering way, and at once lapsed into a heavy sleep. The temperature was  $102^{\circ}$ . There was a leucocytosis of nearly 15,000.

On the morning of the 5th the temperature, which had fallen at 10 P. M. to  $99^{\circ}$ , rose to  $105.6^{\circ}$  at noon on the 5th. There was incessant tremor and clonic movements of the hands and arms. When turned on his side the head was held somewhat backward, and the neck was decidedly stiff. There was no optic neuritis. The patient's temperature remained high from noon on the 5th to 10 P. M., then dropped to  $100^{\circ}$  at 4 A. M. on the 6th. He then became rapidly worse, was profoundly comatose, cyanosed, and there was marked opisthotonos with a great spastic condition of the thumbs.

This morning for the first time purpur was noticed, which came out in quite large spots, especially marked on the legs. By lumbar puncture 10 cc. of turbid fluid was obtained. Cover-slips showed numerous diplococci. Throughout the morning of the 6th the patient became very much worse; the respirations were more rapid and the temperature rose progressively until in the evening at 8 P. M. it reached  $108^{\circ}$ , when he died, on the seventh day of his illness.

Cultures showed very characteristic diplococci. There was no autopsy.

The cases have come from various sections of the city, no two from a single street or house. Dr. Jones, the health officer, tells me that there has been a decided increase lately in the number of deaths certified as meningitis. Dr. Stokes had given him the statistics for the six weeks ending June 15. In 1896 during this period there were thirty-seven deaths from all forms of meningitis, in 1897 twenty-six deaths, while this year there were in the six weeks seventy-one

deaths, a decided increase. Eleven of these had been certified as cerebro-spinal meningitis.

You have had an opportunity, while these early cases were in the wards, to study three other forms of meningitis, the tuberculous the so-called 'occlusive' or posterior meningitis in a child, and that remarkable case of meningitis serosa in a woman in Ward G. Several important clinical features differentiate the meningitis of cerebro-spinal fever from these forms. In the first place, you will notice in marked contrast to the tuberculous form, the suddenness of onset in the cases. The little boy, you remember, was taken abruptly while at play, the little girl when returning from picking peas, and the first case, the colored boy, while he was at work on his mule. In Case 5 I repeatedly called your attention to the fact that though the lad was evidently very ill and quite delirious, yet he responded to questions intelligently, and evidently understood what was said to him. This was noticed in two other cases, and is very unusual in tuberculous meningitis when, as in these patients, the symptoms are pronounced. The more strictly basilar localization of the meningitis in cerebro-spinal fever accounts for the greater mental clearness. The early cases of an outbreak are always difficult to recognize, and though we had a strong suspicion as to the character of our first cases, we did not arrive at a positive conclusion until the fifth, sixth and seventh cases came under observation.

The symptoms presented by the cases were very characteristic, more particularly in all of them the stiffness of the muscles of the neck and back. The little girl, you remember, had such a degree of rigidity that the hand could be placed under the head and the whole body moved like a statue. She had also in the last day of her illness extreme opisthotonos, with aggravated stretching, extensor convulsions. In Case 7 there was almost tetanic rigidity of the muscles, and at times clonic contraction of the arms. Then in Case 4, the colored man who came in in the fourth week of the disease, though he was rational and the



fever subsided two days after admission, you will remember how stiffly his head was held, and the whole trunk could be lifted, owing to the rigidity of the neck. Early rigidity of the muscles of the neck and extreme tension and opisthotonos are very much more pronounced in cerebro-spinal fever than in any other form of meningitis. The temperature curve in these cases is of great interest. In the last three acute fatal cases it was distinctly remittent in type, and the diurnal range was often as much as two, three or even four degrees. In Case 7 the ante-mortem temperature was unusually high, 108°. You will have noted in connection with the blood the very pronounced leucocytosis in all but Case 4 (a convalescent) to 26,000 in Case 1, to 28,000 in Case 2, to 13,000 in Case 3, admitted in the fifth week, to 45,000 in Case 5, to 25,000 in Case 6, to 15,000 in Case 7.

The skin eruptions, which were so marked in the early epidemics, when the disease was indeed called petechial or spotted typhus, were not marked. In Case 5 there were a few purpuric spots about the neck and chest; in Case 6 there was an erythematous eruption about the neck and hands, and in Case 7 a purpuric eruption appeared on the legs. Herpes occurred in six of the seven cases. There is perhaps no acute fever, not excepting pneumonia, in which herpes is so frequent an accompaniment.

Of late years two points of very great moment in the diagnosis of the disease have been brought out, Quincke's lumbar puncture, which enables us now to make a comparatively early diagnosis, and the determination of the diplococcus intracellularis as the probable cause of the disease. The spinal puncture as recommended by Quincke is a perfectly harmless procedure. As you saw in the wards, it sometimes requires a little skill to get into the canal. Not only does it do no harm, but in some cases it seemed to be beneficial in relieving the pressure. A dry tap does not mean that meningitis is not present. In the cord from Case 5 the exudate in the meninges was of such a buttery consistency that it could not have flowed had tapping been made on the day of his death.

The diplococcus intracellularis was first isolated by Weichselbaum in 1887, and subsequently studied by von Jäger and others. The studies in the Boston epidemics have been of great moment, particularly those of Williams and of Wentworth in the determination of the presence of the diplococcus in the fluid obtained by lumbar puncture. In the thirty-five autopsies reported upon by Councilman, Mallory and Wright, the diplococci were found in cultures and on microscopical examination in all but four cases. In one of these they had previously been found in the fluid withdrawn by spinal puncture; two of the other cases were chronic, and in the fourth case there was a mixed infection with tuberculosis. This large percentage speaks very strongly in favor of the constant association of this organism with the disease.

We need additional careful studies on the various types of the disease. On returning to your home some of you may have opportunities of studying cases. The patients you have seen here presented the ordinary type. The fulminant form, which may kill in from twelve to twenty-four hours, has not been much studied of late, and upon it we need additional careful observations. The chronic type, too, is a very remarkable form. The only case I think we have previously had in the hospital was one of this sort, which I reported some years ago. In it the symptoms may persist for two or three months.

While the prognosis in other forms of meningitis is practically hopeless, that in cerebro-spinal fever is by no means bad for a large proportion of the cases. So far as we know, the meningitis due to the bacillus tuberculosis is uniformly fatal. That associated with the streptococcus, whether developing spontaneously or as a result of injury or ear disease, is also very fatal, and, so far as we know, recovery never occurs in the pneumococcus form. The death rate in cerebro-spinal fever varies greatly. Hirsch puts it from 20 to 75 per cent. Of the 111 cases collected in the monograph by Councilman, Mallory and Wright, seventy-six died, a mortality of 68½ per cent.

The treatment of cerebro-spinal fever is not in a satisfactory state. In our first four cases the recovery, so far as one could judge, did not follow the use of any special drugs or any special plan of treatment. The appearance of the meninges, of the cord and of the base of the brain in Case 5 are not very encouraging as to any possible benefit from medicine. For the fever, sponging and other forms of hydrotherapy should be employed. An ice-cap should be placed upon the head. For the pain it is, as you saw in two of our fatal cases, necessary to give morphia, and it is very warmly recommended by both Stillé and von Ziemssen. Bichloride of mercury may be tried, and

has indeed warm advocates. The question of counter-irritation is an important one. That the profession has abandoned in great part the use of blisters is evidenced by the fact that not one of these seven cases was blistered before admission. If thought advisable, the best method is to touch along the spine lightly with the Paquelin cautery. The use of the cold to reduce the fever, the administration of opium to allay the pain, and careful feeding to support the strength of the patient constitute the extent of our therapeutics in this formidable disease.\*

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\*As I correct this lecture an eighth case has been admitted to the wards.



